

RUNNING HEAD: Attentional processing of the mother

Bosmans, G., Goldblum, E., Braet, C., van de Walle, M., Heylen, J., Bijttebier, P., Santens, T., Koster, E.H.W., De Raedt, R. (in press). Children's attentional breadth around their mother: Comparing stimulus-driven versus cognitively controlled processes. *Social Development*.

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Comparing stimulus-driven versus cognitively controlled processes.**

Abstract

Attentional processes in children are tuned towards their mother. It is unclear whether this is a cognitively controlled or more automatic, stimulus-driven process. Therefore, 172 children (age 9-13) were assigned to either a cognitively controlled or a stimulus-driven task measuring the breadth of their attentional field around their mother. Results demonstrated a narrower field around the mother for children completing the more stimulus-driven task. Moreover, only for the stimulus-driven task, this effect was linked with the interaction between children's age and self-reported trust in maternal support. More trust was linked with a narrower attentional field around the mother in younger children, but with a less narrow field in older children. This resembles the expected age-related shift towards increased autonomy and points at stimulus-driven attentional processes.

Keywords

Attachment, middle childhood, attentional bias, attentional breadth, trust, mother-child relationship

Children's attentional breadth around their mother:**Comparing stimulus-driven versus cognitively controlled processes.**

According to attachment theory, primary caregivers like mothers are crucial for children's development because young children need their mother to ensure survival (Bowlby, 1969). Bowlby (1969) proposed that care-related experiences with the mother are stored as an internal representation or internal working model. When infants repeatedly experience sensitive maternal responses to distress, they develop secure attachment representations, which means that they will trust that they can rely on the mother as a secure base from which to solicit support (Bowlby, 1969; Waters & Waters, 2006). Instead, in the context of absent or inconsistent maternal responses to distress, children develop insecure attachment representations and less trust. These internal working models determine how future information regarding caregivers will be cognitively processed (i.e., attention, memory, and interpretation), affecting perceived social support and later social interactions with caregivers, peers, and romantic partners (Bowlby, 1969). Although the actual nature of these internal working models is still a topic of fierce debate (Rutter, 2014; Thompson, 2008), accumulating research suggests that studying biases in the cognitive processing of attachment-related information increases our understanding of this so-called "black box" of attachment theory (Dykas & Cassidy, 2011; Zimmerman & Iwanski, 2015). The current study focuses on further unravelling the nature of one such bias: the breadth of children's attentional field around their mother (Bosmans, Braet, Koster, & De Raedt, 2009).

Attentional breadth refers to the breadth of children's attentional field around stimuli that are presented centrally in their visual field (Derryberry & Tucker, 1994). If children have a more narrow attentional field around their mother, this means that they are less able to process stimuli that appear far from compared to close by the mother. The importance of this bias for the attachment system is reflected in the significant link that has been found between children's attentional breadth around their mother and children's observable behavioral strategies to use their mother as a source for support (Bosmans, Braet, Heylen, & De Raedt, 2015). One important question with regard to this effect is whether this increased attentional focus is the result of more strategic, cognitively controlled processes (e.g., children can influence whether they focus their attention on their mother), or more stimulus-

driven processes. Stimulus-driven processing would mean that attention is more automatically focused on the mother and that the child is less aware of the process or is less able to strategically influence the process (e.g., Yantis, 1993). It is important to note that all information processing reflects a mixture of strategic and stimulus-driven processes, but that one processing mode could be more dominant than the other (Moors, 2016). In view of attachment theory's general assumption that the attachment system consists for a substantial part of automatic/unconscious processes (Bretherton & Munholland, 2008; Maier, Bernier, Pekrun, Grossmann, & Zimmermann, 2004; Main, Kaplan, & Cassidy, 1985), one can hypothesize that attentional focusing on the mother may predominantly occur automatically. Yet, evidence for more dominant automatic attachment processes is surprisingly scarce given its theoretical importance for attachment theory (e.g., Maier et al., 2004). Therefore, finding empirical evidence in favor for such automatic processes would significantly contribute to our understanding of the attachment system.

At present, most evidence that children have an attentional preference for their mother stems from studies that measure attention as a cognitively controlled process. For example, research shows that when 8-12 year old children are exposed to pictures displaying their mother as well as unfamiliar women for a longer time (10 seconds) without any instructions or tasks, they freely direct their gaze longer towards their mother (Vandevivere, Braet, Bosmans, Mueller, & De Raedt, 2014). With regard to more stimulus-driven processes, evidence is less clear because most existing paradigms rely on presentation times that allow strategic cognitive processes (e.g., Dykas & Cassidy, 2011; Zimmerman & Iwanski, 2015). For example, in several attention processing studies, 12-16 month old children were asked to look at video-clips (Johnson, Dweck, & Chen, 2007), three year olds were asked to look at a puppet play (Belsky, Spritz, & Crnic, 1996), or six year old children were asked to look at pictures of their own family (Main, Kaplan, & Cassidy, 1985). The dependent variable of this task is amount of time children decide to look at these stimuli. Therefore, it remains unclear whether biases can occur in a more stimulus-driven way. To date, the best evidence in favor of stimulus-driven processes underlying attentional preference for the mother has been found in attachment-related attentional breadth studies. Here a picture of the mother and other task-relevant stimuli are presented for only 34 ms and influences of attachment-related processes are already observed (Bosmans et al., 2009).

Research on children's attentional breadth around their mother supports the claim that children's attentional processing of attachment figures helps to understand the role of trust in their development (Bosmans, Koster, Vandevivere, Braet, & De Raedt, 2013). Applied to attachment, Bosmans et al. (2009) investigated the breadth of 10-12 year old children's attentional field around a picture of their mother with the Attentional Breadth Task (ABT). During this task, children are asked to locate target stimuli presented close to or far from central stimuli presented on a computer screen (see Figure 1). Henceforward, these target stimuli will be referred to as close and far target stimuli. The breadth of children's visual field can be derived from their ability to locate far target stimuli as compared to their ability to locate close stimuli. Children who are equally successful in both types of target stimuli, have a less narrow attentional field than children who perform worse in far stimuli. To derive the extent to which children's attentional field narrows around their mother, the content of the central stimulus is manipulated: faces appear of either children's own mother, or of unfamiliar women. Trials are presented for 34ms. Longer presentation times would allow children to scan the computer screen by making eye movements to find the location of the target stimulus. In such case, task performance would not reflect the breadth of the attentional field around the central stimulus, but children's visual scanning capacity. Using a presentation time that is shorter than an eye saccade controls for potential confounds due to visual scanning. To ensure that children's attention is focused on the center of the screen, children are first asked to identify which picture is presented centrally (i.e., mother versus unfamiliar women). Analyses are only conducted on the trials in which children correctly identify the central stimulus (i.e., mother versus unfamiliar women). This is again to avoid measurement error. Otherwise, peripheral target stimuli can be correctly identified if children coincidentally look at the location where the target stimulus is presented. With this task, Bosmans et al. (2009) found that children have a narrower attentional field around their mother compared to unfamiliar women.

However, because children were asked to identify who is presented as the central picture (i.e., mother versus unfamiliar women), it remains unclear to what extent this effect is stimulus-driven. This instruction might have primed children to think about their mothers, which could have induced a cognitive evaluative process that subsequently affected the results. To investigate whether children's

attentional narrowing around their mother is a stimulus-driven process, we developed an ABT during which children were instructed to pay attention to a mother-irrelevant feature of the central stimulus (the color of the frame around the central picture; see Figure 2). If children's attention is more attuned toward their mother in this new version of the ABT in which attachment-related stimulus content (i.e., picture of their mother versus an unfamiliar woman) is not relevant to the task, this would be a strong indication that the effect that children have a more narrow attentional field around their mother compared to unfamiliar women is predominantly stimulus-driven.

Current Study

To test the extent to which children's attentional breadth around their mother is a stimulus-driven process, we compared a group of children's performance on the original version of the ABT (here referred to as original ABT) to a group of children's performance on an adjusted version of the ABT (referred to as adjusted ABT) in a between-subject research design. Provided that attentional settings are a key determinant of which stimuli attract attention (Folk & Remington, 2008) observing attentional breadth in the frame-color condition would be strong evidence for a predominantly automatic or stimulus-driven attentional capture.

Additionally, we tested whether the breadth of children's attentional field around their mother was linked to how much they trusted in their mother's availability for support. Previous research with the original ABT found mixed evidence for such a link. Some studies found that children with less trust in maternal support had a narrower attentional field around their mother (Bosmans, Braet, et al., 2015; Bosmans et al., 2009). However, this effect was less consistent than initially thought, with some studies failing to replicate (Bosmans et al., 2013; Claes, De Raedt, Van de Walle, & Bosmans, 2016). Moreover, an analysis with 428 children showed that the effect remained significant, but was small ($r = .13, p < .05$; Bosmans et al., 2016). One reason for these mixed results could have been that the effect in the original ABT was to some extent suppressed by the fact that cognitively controlled processes interfered with the stimulus-driven processing of the central picture. Consequently, we predicted to find stronger correlations between trust and the breadth of children's attentional field around their mother when measured with the adjusted ABT.

Finally, we tested for age effects on the interaction between ABT type and trust on children's attentional breadth around their mother. So far, this effect has been mainly studied in middle childhood because at that age, the impact of cognitive processes in attachment development is supposed to become increasingly important (Main, Kaplan, & Cassidy, 1985). From infancy onwards, children need to learn to trust in maternal support. This allows them to gradually learn to temporarily detach from their mother's proximity in order to acquire new information about their environment and to acquire new skills to face the challenges they encounter during exploration (Bowlby, 1969). An accumulating number of studies demonstrate that middle childhood is a transition period of attachment development (Bosmans & Kerns, 2015). During middle childhood, children develop verbal scripts about maternal care (e.g., Waters, Bosmans, Vandevivere, Dujardin, & Waters, 2015). These scripts gradually reduce their need for the constant physical availability of their mother. Instead they increasingly learn to trust that they can rely on their mother more as a resource when confronted with social and academic distress to safeguard adaptive development (Dujardin et al., 2016; Koehn & Kerns, 2015). This further promotes children's ability to detach from their mother and to explore (Bosmans & Kerns, 2015; Del Giudice, 2014; Koehn & Kerns, 2015). If children fail to develop trust in the availability of their mothers' support, they remain focused on their mother to the extent that their exploration of their environment is hampered (Bosmans, Dujardin, Field, Salemink, & Vasey, 2015; Dujardin, Bosmans, De Raedt, & Braet, 2015).

Age effects on the attentional breadth-trust association could be expected because of this developmental shift in children's attachment needs. At the start of middle childhood, children are mainly focused on physical proximity to their mother. At the end of middle childhood, children who are more confident that their mother will be available when they need her support no longer need her proximity (Bosmans & Kerns, 2015). Instead, children with less confidence remain focused on their mother (Van de Walle, Bijttebier, Braet, & Bosmans, 2016). Therefore, it can be predicted that in younger children, more trust in maternal support is linked to an enhanced focus on the mother. In older children, one could predict that children with more trust are less focused on their mother. Thus far, no age-effects have been found on the attentional breadth-trust association (Bosmans, Braet, et al., 2015; Bosmans et al., 2009, 2013). However, this could have been due to a less optimal design of the

original ABT. Therefore, we predict that this moderating effect of age will be significantly stronger in the adjusted ABT compared to the traditional ABT.

In summary, the current study aimed to test the hypothesis that the breadth of children's attentional field around their mother is a more stimulus-driven process. For that purpose, we compared children's performance on either the original or the adjusted ABT in a between-subject design. We predicted that effects would be stronger with the adjusted ABT. First, we predicted that children on the adjusted ABT would display a narrower attentional field around their mother compared to children who carried out the original ABT. Second, we predicted that trust would correlate more clearly with attentional breadth as measured with the adjusted ABT compared to the original ABT. Third, we predicted that this association is moderated by age.

Method

Participants

The sample in this study consisted of 172 elementary school children ranging from 9 to 13 years of age ($M = 10.56$, $SD = 0.98$), with 90 male participants and (52%) 82 female participants (48%). Of these children, 136 had parents who lived together (79%), 28 had divorced parents, (17%) 2 had one parent who was deceased (1%), 2 reported different family situations (1%), and 4 had missing data (2%). 168 lived with their biological mother (98%), and the remaining 4 had missing data (2%). All children had their mother as primary attachment figure during the first three years of their lives.

Measures

Original Attentional Breadth Task (ABT; Bosmans et al., 2009). This task was programmed in INQUISIT Millisecond software, and was presented on an IBM-compatible computer. Participants were seated in front of a 19" CRT-computer screen at a distance of precisely 27 cm (to obtain the precise visual angle for the stimuli), and a chin rest was used to ensure consistent accurate facial positioning. Participants indicated their responses with a computer mouse. During each trial a 3cm by 4cm picture appeared in the center of the screen. Two categories of central pictures were presented: pictures of children's own mother versus pictures of unfamiliar women. Ten pictures of the participant's own mother's face were taken during the lab visit. The faces of ten different unfamiliar women were chosen beforehand as a comparison. In this way, potential effects of attractiveness,

similarities in appearance to the mother in question, or any other salient properties were avoided. The unfamiliar women were all mothers as well. In all of the pictures bright colors and bare teeth were avoided, and all photographed women were instructed to maintain neutral facial expressions in order to minimize salience effects.

Simultaneously with the presentation of the central picture, 16 gray dots of 2 cm in diameter appeared at 4.5 cm from the central picture (close trials at 10° of the visual angle) and at 11.2 cm from the central picture (far trials at 25°) (see Figure 1). These gray dots were arranged in pairs, and positioned on eight axes that converged upon the central picture. Concurrently, a target stimulus, a smaller black circle 1.3 cm in diameter, appeared in one of the close dots or in one of the far dots. After each trial, a screen appeared asking the participants whether the picture they had seen was a picture of their mother or of an unfamiliar woman. A correct response to this question indicated that the participant focused on the picture at the center of the screen. Next, a second screen appeared asking the participants on which of the eight axes the target stimulus was located (see Figure 1).

All instructions were displayed on the computer screen and read together with the experimenter prior to testing. Participants were given the opportunity to ask clarifying questions whenever necessary. Additionally, participants were instructed to use the chin rest and to maintain their gaze on the center of the screen for the duration of the experiment. Furthermore, an eight-trial practice session was conducted in order to familiarize the participants with study procedures. During the test trials, four categories of trials were presented during 34ms, with two different picture types (mother versus unfamiliar women) and two alternate distances (close versus far trials). For each category, there were 32 trials. The trials were presented randomly in two blocks, separated by a short break.

For all analyses, only trials were used where the central picture had been correctly identified to ensure that attention was focused on the middle of the screen. The proportions of accurately identified targets in trials with accurately identified central pictures for each of the four trial categories served as the dependent variables for the first research question. Next, an Attentional Narrowing Index (ANI) was calculated by subtracting the proportion of accurately identified targets on the far trials from the proportion of accurately identified targets on the close trials. The ANI was calculated

separately for mothers (ANImother) and for unfamiliar women (ANIunfamiliar). Lastly, the ANI difference effect (difANI) was calculated by subtracting ANIunfamiliar from ANImother. This index reflects the extent to which the decrease in attentional breadth was stronger around pictures of the participant's mother compared to those of the unfamiliar women. Higher difANI scores suggested a narrower attentional field around pictures of the participant's mother. This score was used as dependent variable for the second and third research question.

Adjusted ABT. The adjusted ABT procedure and instructions were kept the same, but rather than asking for the identity of the person depicted in the center of the screen, participants were instructed to identify one of the two alternating colors (light gray or dark gray) of a thin, rectangular frame that appeared around the central picture (see Figure 2). Within each frame color, an even number of mother and unfamiliar women pictures were presented. For the analyses, only the trials were used for which children correctly identified the color of the central picture's frame. The proportions of accurately identified targets in trials with correctly identified frames for each of the four trial categories (mother versus unfamiliar and close versus far) served as the dependent variables for the first research question. ANImother, ANIunfamiliar, and difANI were calculated in exact the same way as for the original ABT. difANI was again used as dependent variable for the second and third research questions.

People In My Life Questionnaire: Mother Scale (PIML, Ridenour, Greenberg, & Cook, 2006). Trust in maternal support was assessed using the Trust-scale of the PIML, which assesses a participant's trust in receiving support from the attachment figure (Allen, Porter, McFarland, McElhaney, & Marsh, 2007; Belsky, Jaffee, Hsieh, & Silva, 2001). The Trust-scale consists of 10 items such as "I can count on my mother to help me when I have a problem." Children responded on a 4-point Likert-scale (1 = *almost never true* and 4 = *almost always true*). Previous research showed that trust is linked to children's observed support seeking behavior during distress (Bosmans et al., 2015). Higher scores on this scale indicated greater levels of trust in the mother's support. In the current sample, the internal consistency was very good ($\alpha = .83$).

Procedure

Children and mothers were invited to participate in the study using flyers distributed in randomly selected schools. All respondents to the flyers were called up and informed about the goal and procedure of the study. All contacted respondents agreed to participate and gave their written informed consent. To increase the comparability between the two groups, we used propensity score matching (Garrido et al., 2014). First, the adjusted ABT sample was collected ($n = 86$). Their ages ranged from 9-13 ($M = 10.57$, $SD = .98$), 44 of whom were male (51%) and 42 of whom were female (49%). Of these children, 76 had parents who lived together (89%), 8 had parents who were divorced (9%), and 2 had alternative family situations (2%). All 86 children lived with their biological mother. Second, we aimed to match each participant to its nearest neighbor from a large sample of 428 children who carried out the original ABT as part of previous studies (see Bosmans et al., 2016). Therefore, propensity scores were estimated using a binary logistic regression model in which original versus adjusted ABT was regressed on the baseline characteristics Age, Gender and Trust. Each participant who carried out the adjusted ABT was matched on the propensity score to a child who carried out the original ABT.

Three one-way analyses of variance (ANOVA) were conducted to determine whether the propensity score matching yielded two equal groups for Trust, Gender, and Age. No significant differences were found ($F_s < .09$), suggesting that the propensity score matching was successful and that both groups were comparable regarding age, gender, and level of trust.

In both samples, the order of the procedure was identical. First pictures of the mother were taken, then children's trust was measured. Finally, the ABT was administered. This study protocol was reviewed and approved by the K.U. Leuven Institutional Review Board.

Results

Preliminary Analyses

Two one-way ANOVAs were conducted to determine whether there were gender effects on Trust and difANI. There was only a significant Gender effect on Trust, $F(1, 170) = 18.55$, $p < .001$,

with girls ($M = 3.72$; $SD = .33$) scoring higher than boys ($M = 3.50$, $SD = .36$; $d = .64$). Age did not correlate with difANI and Trust ($r_{\text{age, difANI}} = .04$, $p = .64$; $r_{\text{age, Trust}} = -.08$, $p = .31$).

Research Question 1: Is The Breadth of Children's Attentional Field around their Mother Conditional upon ABT Condition?

A 2 (between subject Condition: Original versus Adjusted ABT) x2 (within subject Distance: Close versus Far Trials) x2 (within subject Picture: Mother versus Unfamiliar) repeated measures ANOVA was performed to test the prediction that children's breadth around their mother is more narrow when measured as a stimulus-driven process. Results showed a main effect for Distance, $F(1, 169) = 178.94$, $p < .001$, $\eta^2 = .51$, with more identified targets in the Close versus Far Trials (see Table 1). Furthermore, there was a Condition X Distance interaction effect, $F(1, 169) = 24.154$, $p < .001$, $\eta^2 = .13$, reflecting more identified targets in the Close Trials of the Original ABT compared to the Adjusted ABT (Table 1). In line with previous research showing attentional preference for their mother, there was a significant Picture X Distance effect, $F(1, 169) = 17.77$, $p < .001$, $\eta^2 = .10$, with a stronger attentional narrowing around the Mother compared to the Unfamiliar women (Table 1). In line with the current study's hypothesis, there was a significant 3-way interaction between Condition, Distance, and Picture, $F(1, 169) = 8.47$, $p = .004$, $\eta^2 = .05$. In order to probe this effect, a 2 (Distance) x 2 (Picture) repeated measures ANOVA was performed for both conditions separately.

For the Original ABT, there was only a main effect of Distance, $F(1, 84) = 142.63$, $p < .001$, $\eta^2 = .63$, with Close Trials producing more accurate responses than Far Trials, and a marginally significant Distance x Picture interaction effect, $F(1, 84) = 3.42$, $p = .068$, $\eta^2 = .04$. For the Adjusted ABT, there was a significant effect of Distance, $F(1, 84) = 43.09$, $p < .001$, $\eta^2 = .34$, and a significant Distance x Picture interaction, $F(1, 85) = 14.651$, $p < .001$, $\eta^2 = .15$. A paired-samples t-test comparing children's scores on ANImother versus ANIunfamiliar demonstrated a more narrow attentional field around the mother compared to the unfamiliar women, $t(85) = 3.83$, $p < .001$, $d = .61$. Finally, to test whether this indeed means that children's attentional breadth around their mother was more narrow in the Adjusted compared to the Original ABT, an independent samples t-test was conducted on difANI, demonstrating a significant task effect with higher difANI scores on the

Adjusted ABT, $M = .16$ ($SD = .39$) than on the Original ABT, $M = .02$ ($SD = .15$), $t(170) = 3.05$, $p = .003$, $d = .47$.

Research Question 2: Does Trust Correlate with Children's Attentional Breadth around their Mother Conditional upon ABT Condition?

A multiple regression analysis was conducted to examine the moderating effect of Condition (Original ABT versus Adjusted ABT) on the association between Trust and difANI (defined as the decrease of the breadth of children's attentional field around their mother compared to the breadth of their attentional field around unfamiliar women). No significant main effect of Trust was found ($\beta = .05$, $p = .49$) and no significant interaction was found between Condition and Trust ($\beta = -.004$, $p = .961$).

Research Question 3: Is the Trust X ABT Condition interaction on Attentional Breadth around the Mother Conditional upon Age?

A multiple regression analysis was conducted to examine the three-way interaction between age, Condition (Original versus Adjusted ABT) and Trust in the prediction of difANI (see Table 1). With all predictors entered, there was a significant 3-way interaction. Figure 3 displays the interaction effect. Follow-up interaction analyses for the original and adjusted ABT separately found no significant interaction effect in the original ABT, $t(86) = .94$, $p = .35$, but a significant interaction effect in the adjusted ABT, $t(86) = 2.49$, $p = .015$. Johnson-Neyman post-hoc probing showed that the slope of the association between Trust and attentional breadth around the mother was significantly positive until the age of 9.69, while the slope became significantly negative after the age of 12.38, showing that a more narrow attentional field around the mother was linked to more trust in the younger children but linked to less trust in the older children. Adding Gender as covariate did not affect the three-way interaction effect ($\beta = -.20$, $p = .009$).

Discussion

The current study aimed to investigate whether children's attentional attuning towards their mother is a more stimulus-driven or a more cognitively controlled process. For this purpose, we compared children's performance on two tasks (the original versus the adjusted Attentional Breadth Task) that differed in the extent to which they measured children's attentional breadth around their

mother as a stimulus-driven process (depending on whether attachment-information was task-(ir)relevant). The reduction of children's attentional field around their mother was significantly stronger and only observed when attachment related information was task-irrelevant and there was thus less time for controlled processing strategies. In none of the tasks, a main effect was found regarding the link between children's attentional breadth around their mother and children's trust in their mother's availability for support. However, age more strongly affected the trust-attentional breadth link when attachment information was task-irrelevant. In the latter task, more trust was linked to a more narrow attentional field around the mother when children were younger. Instead, when children were older, more trust was linked with a less narrow attentional field around their mother.

The current study's first research question focused on whether the breadth of children's attentional field around their mother is a more stimulus-driven or a more cognitively controlled process. Results were in line with research that used attention paradigms during which children had more cognitive control regarding whether they could orient their attention to their mother versus unfamiliar women (Bosmans, De Raedt, & Braet, 2007; Vandevivere et al., 2014). Both the current studies and the studies of Bosmans et al. (2007) and Vandevivere et al. (2014) show that children have a stronger attentional focus on their mother compared to other, unfamiliar women. The current study adds to previous research by demonstrating that attentional preference for the mother occurs also and even more strongly at a stimulus-driven level. This suggests that the mere presentation of the mother as a stimulus in children's attentional field draws attention to her, even when children are focused on other tasks that are unrelated to identifying their mother, like distinguishing colors. This finding makes sense in light of the lifelong salience of the mother for children, first as a source for survival, and later as resource for support during distress (Bosmans & Kerns, 2015; Bowlby, 1969; Shaver & Mikulincer, 2007). One possibility is that this bias reflects an inborn biological mechanism that supports the proximity and support seeking function of the attachment system (Bosmans et al., 2015). If the neurocognitive system is more strongly focused on mother, it is more likely that children will turn to their mother when they need her support (e.g., Van de Walle et al., 2017). This way, the odds may increase that children experience the sense of felt security that is a well-known source for resilience in children's lives.

Regarding the second research question, no overall association was found between children's trust and the breadth of their attentional field around their mother. Moreover, type of ABT did not moderate this association. In this way, the current finding adds to an accumulating number of studies that illustrate that a narrower attentional field around the mother can be found in children with both high and low trust (Bosmans et al., 2013; Claes et al., 2016; Van de Walle et al., 2017). The latter studies consistently showed that the quality of the parent-child relationship is the context that determines whether a narrow attentional field around the mother is a liability or a strength. More specifically, children's more narrow attentional field around their mother appeared to be linked to lower symptoms of emotional and behavioral problems in children with high levels of trust in mother. At the same time, the same narrow attentional field around the mother was linked to the highest levels of symptoms in children with low levels of trust in mother. This observation is in line with accumulating evidence across areas of attentional bias research showing that attentional bias should not be considered a stable maladaptive process, but rather is a highly dynamic process with contextual variables determining its adaptive or maladaptive nature (Notebaert, Bernstein, Zvielli, Clarke, & Koster, 2016). Unfortunately, in the current study, data to further test such moderating effects of attentional breadth on children's adaptive or maladaptive developmental outcomes was lacking. It would be valuable to further test in future research, whether this moderating effect of attentional breadth on the link between context and developmental outcomes also increases when attention is measured as a more stimulus-driven process.

In support of the claim that there might be no straightforward link between trust and the breadth of children's attentional field around their mother, analyses for the current study's third research question suggest that age moderates the direction of the association between trust and children's attentional breadth around their mother when measured as a stimulus-driven process. When attention was measured using the original ABT, no age effects were found, like in the previous studies with that task (Bosmans, Braet, et al., 2015; Bosmans et al., 2009). The significant age-effect for the adjusted ABT showed that for children younger than 9.69 years, more trust was linked with a more narrow attentional field around the mother. For children older than 12.38 years, more trust was linked with a less narrow attentional field around the mother. This finding seems in line with the transition

observed in middle childhood attachment development. Whereas at the start of this developmental period, there is a stronger focus of children on the mother's physical proximity to feel safe and supported, this attachment need shifts to the need to be assured that the mother will be available in order to be able to freely and autonomously explore their broader environment at considerable distance from mother (Bosmans & Kerns, 2015; Koehn & Kerns, 2015). Therefore, it makes sense that young children with more trust more easily focus on mother, whereas older children with more trust are automatically less focused on mother, allowing them to explore their environment (see for example, Dujardin et al., 2015).

When evaluating the relevance of these effects, it is important to keep the study's limitations in mind. First, the use of a between-subject design is a disadvantage. Comparing children's performance on both versions of the ABT would have allowed stronger conclusions regarding the effect of the manipulation of asking children to focus on their mother versus asking to focus on the color of the frames around the central picture. However, in a pilot study during which we tested children twice on the ABT, we found strong order effects. Such order effects would have introduced noise and would have made it more difficult to examine differences in function of the task-relevance of attachment-related information. Additionally, individual differences in children's trust were measured with a self-report questionnaire. Although previous research with that measure confirms that the trust scale is linked to children's observable support seeking behavior (Bosmans, Braet, et al., 2015) and to other measures like interviews of which the validity is less questioned (Borelli et al., 2015), there is a general concern that self-report is vulnerable to false secure attachment scores (Ainsworth, 1985). In future research, it would be valuable to repeat the study with more narrative measures like interviews or secure base script tests, because they are less vulnerable to response biases (Waters et al., 2015). Moreover, we did not include a measure of attachment anxiety and attachment avoidance. Because research suggests that both insecure attachment styles are linked with opposite attentional bias effects (respectively hypervigilance versus disengagement; Dykas & Cassidy, 2011), this might have suppressed the association between trust and attentional breadth. Also, age effects on the link between trust and attentional breadth around mother were never found in research with the original ABT. Nevertheless, the current findings support many scholars' prediction that children

should change throughout this age-period in how they perceive their mother (e.g., Koehn & Kerns, 2015). The overall indication in the current study that the adjusted ABT is a more appropriate test of children's attentional breadth around mother might help explain why the new version of the task found more evidence in favor of such an age-effect. However, this finding is in clear need of replication and should also be tested in a sample with a wider age-range because that should increase the impact of the developmental shift that occurs in middle childhood. Finally, the results are limited because they only focus on the relationship children have with their mother. Although this means that it is not possible to generalize the current findings beyond the mother-child attachment relationship, the findings remain important because for most children, the mother is the primary attachment figure in middle childhood (Kerns, Tomich, & Kim, 2006). Nevertheless, it would be valuable to extend this study to other attachment figures to test the general expectation that these basic processes are independent of who is the child's main attachment figure.

In summary, the current results suggest that children's attentional preference for mother occurs as a stimulus-driven process. This finding is important because this has been one of the few studies that tried to test the traditional claim that unconscious processes drive the attachment system (Maier et al., 2004). The current study supports that claim as it illustrates that children's attention is drawn to mother even if they are involved in a different task and even if they do not have the time to decide which information to focus upon.

Funding Acknowledgements

This research was supported by Grants G.0934.12 and G.0774.15 of the Research Foundation Flanders (FWO), Grants OT/12/043 and CREA/12/004 from the Research Fund KU Leuven, Belgium

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Table 1: Means of Proportion of Correctly Identified Trials by Picture and Distance

Picture	Distance	Original ABT		Adjusted ABT	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Mother	Close	.46	.27	.36	.19
	Far	.17	.08	.15	.19
Unfamiliar	Close	.44	.23	.25	.21
	Far	.18	.09	.20	.14

Table 2: *Linear Regression of the Interaction Between Trust x Age x Condition on difANI*

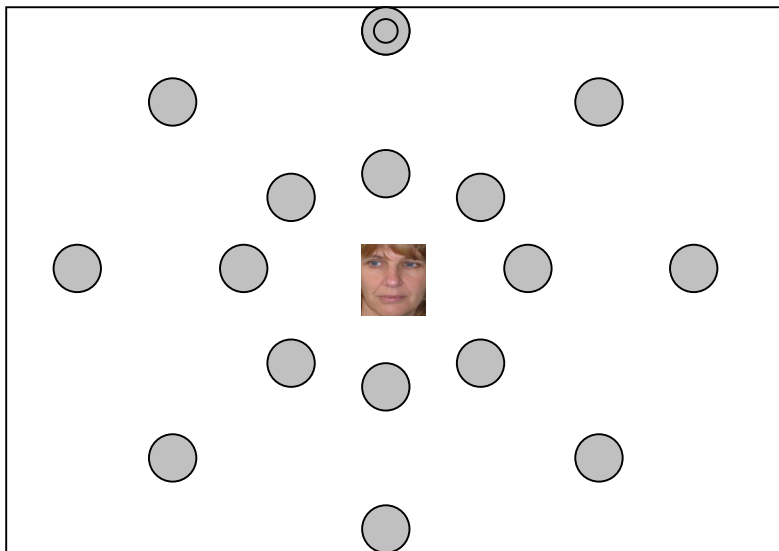
	β	ΔR^2
Step 1		.06*
Condition	.21**	
Age	.03	
Trust	.06	
Step 2		.03
Trust x Condition	-.00	
Trust x Age	-.14*	
Condition x Age	.05	
Step 3		.04**
Trust x Condition x Age	-.20**	

* $p < .05$, ** $p < .01$, *** $p < .001$; reported β s reflect values at Step 3

Figure 1: Stimulus presentation Original Attentional Breadth Task

Figure 2: Stimulus presentation Adjusted Attentional Breadth Task

Figure 3: Three-way interaction between Trust, Age, and ABT Task Type on difANI (difference between Attentional Narrowing Indexes around mother versus unfamiliar women, reflecting attentional narrowing around mother)



Screen 1 (far trial)

Who did you see in the middle of the screen? Select "1" or "2"

Mother

1

Unfamiliar

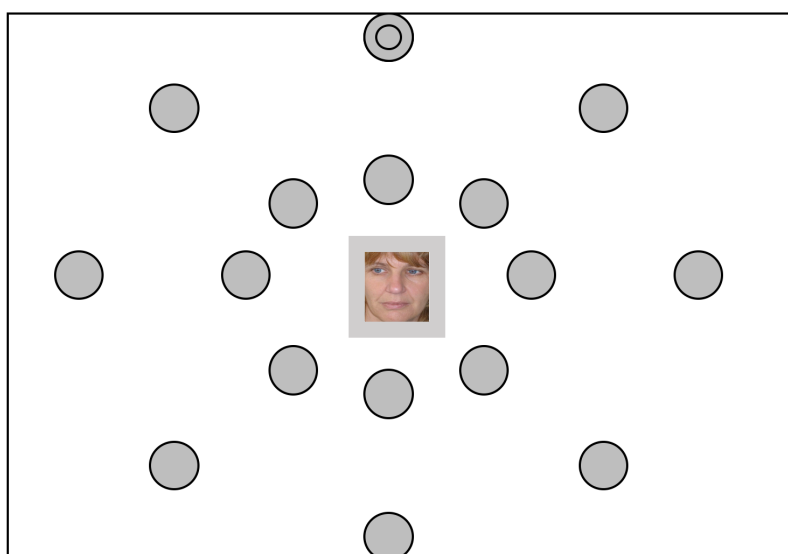
2

Screen 2

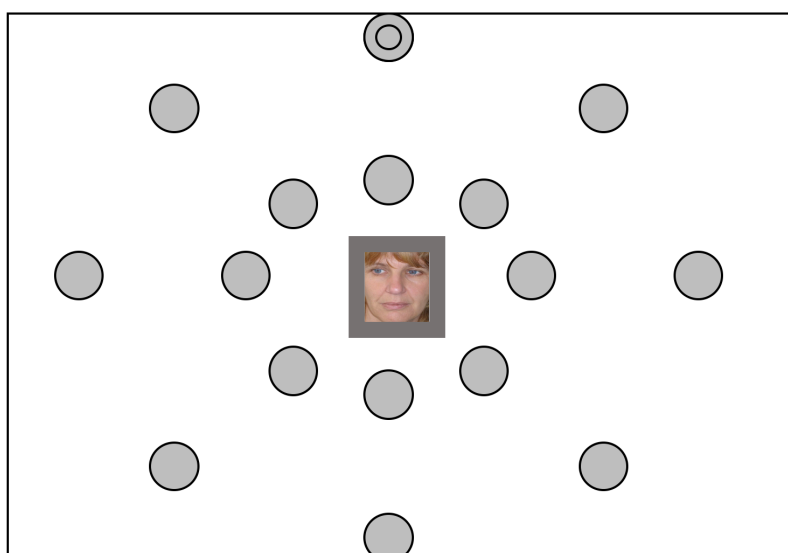
 A coordinate system with 8 axes labeled 1 through 8. Each axis has a gray circle at its end. The axes are: 1 (horizontal left), 2 (diagonal up-left), 3 (vertical up), 4 (diagonal up-right), 5 (horizontal right), 6 (diagonal down-right), 7 (vertical down), and 8 (diagonal down-left).

On which axis the circle appeared? Select the corresponding number.

Screen 3



Light Gray Frame



Dark Gray Frame

